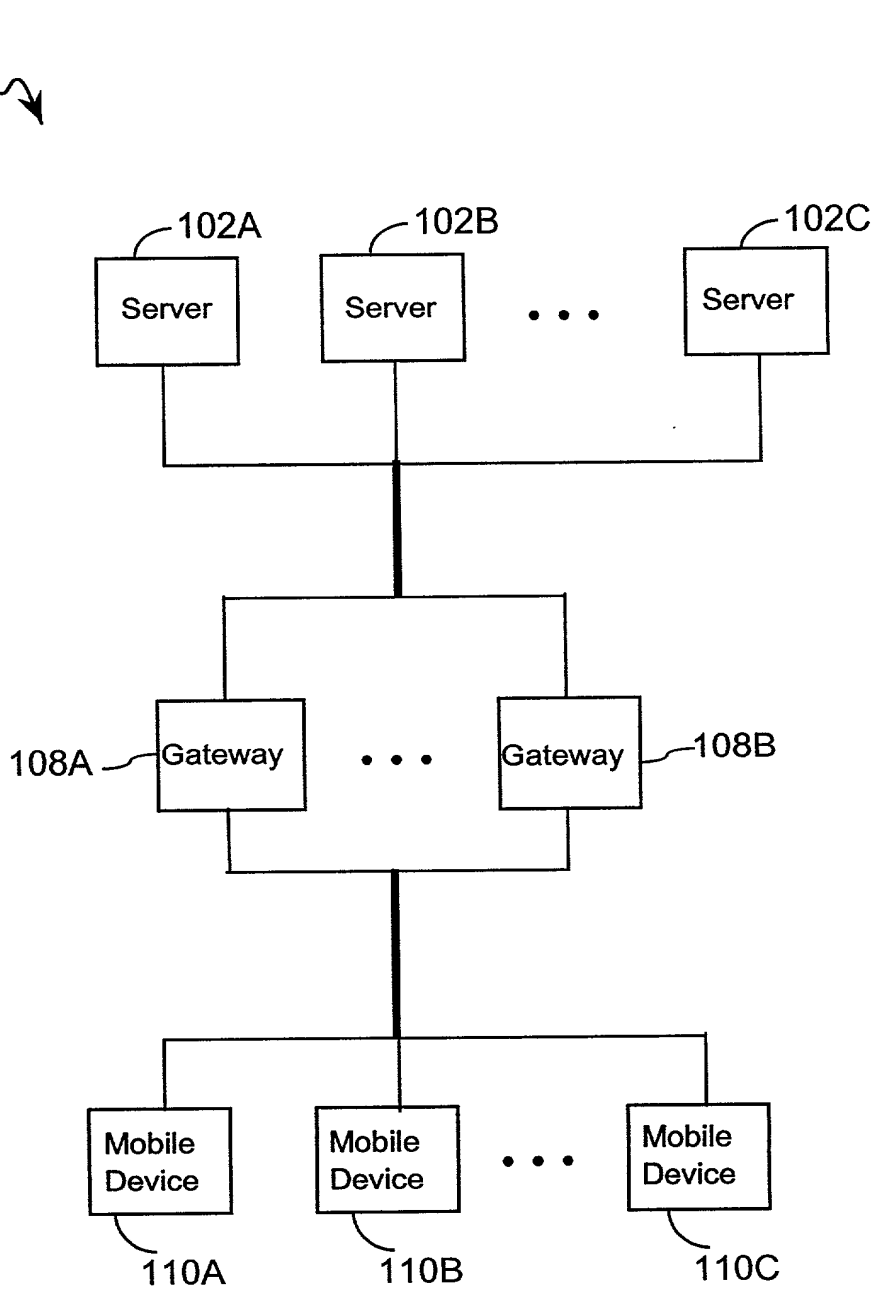
100
102A
102B
102C
Server
Server
Server
108A
Gateway
Gateway
108B
Mobile Device
Mobile Device
Mobile Device
110A
110B
110C

FIG. 1

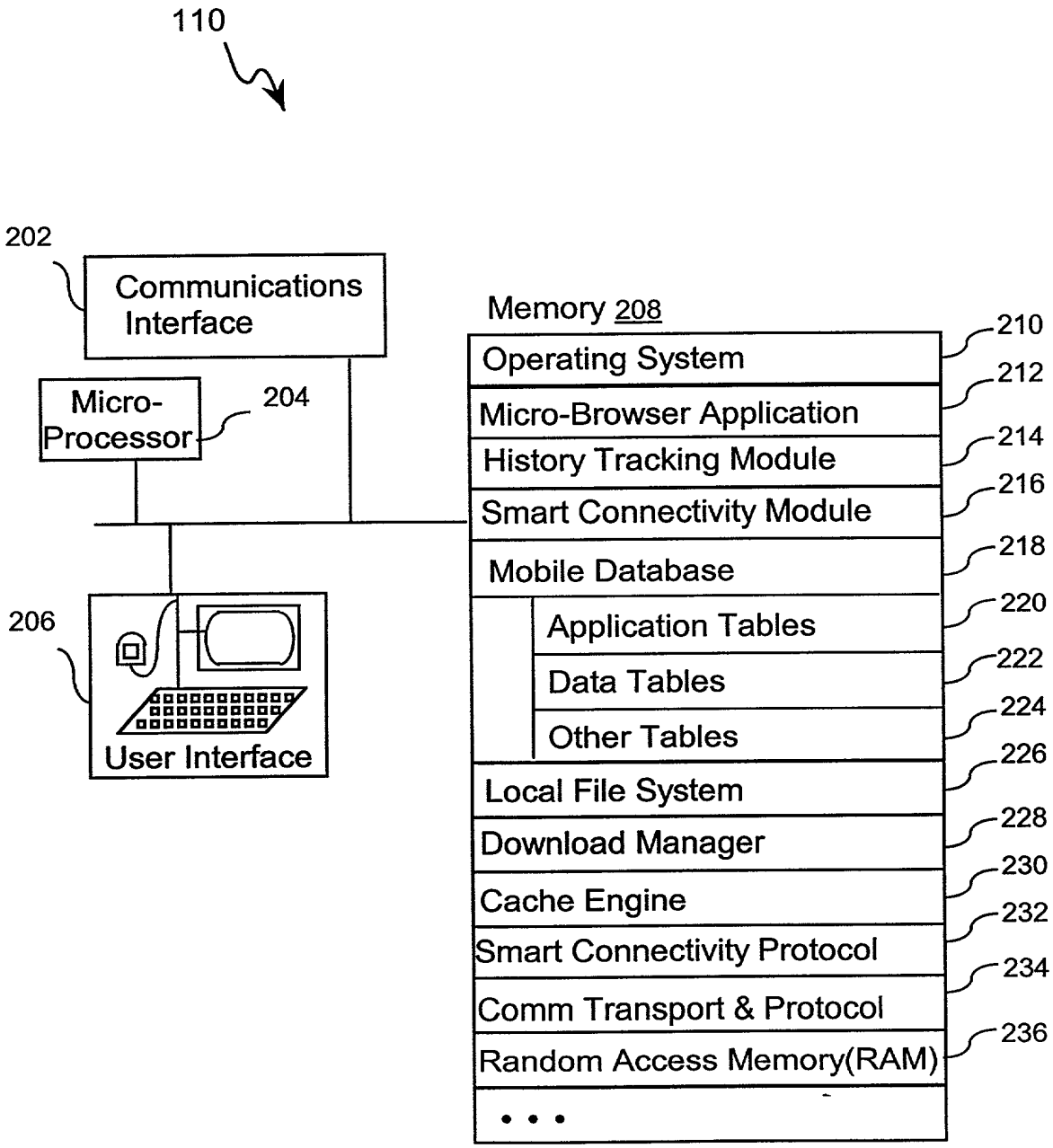
110
202
Communications Interface
Micro-Processor
204
206
User Interface
Memory 208
Operating System
210
Micro-Browser Application
212
History Tracking Module
214
Smart Connectivity Module
216
Mobile Database
218
Application Tables
220
Data Tables
222
Other Tables
224
Local File System
226
Download Manager
228
Cache Engine
230
Smart Connectivity Protocol
232
Comm Transport & Protocol
234
Random Access Memory(RAM)
236
• • •

FIG. 2

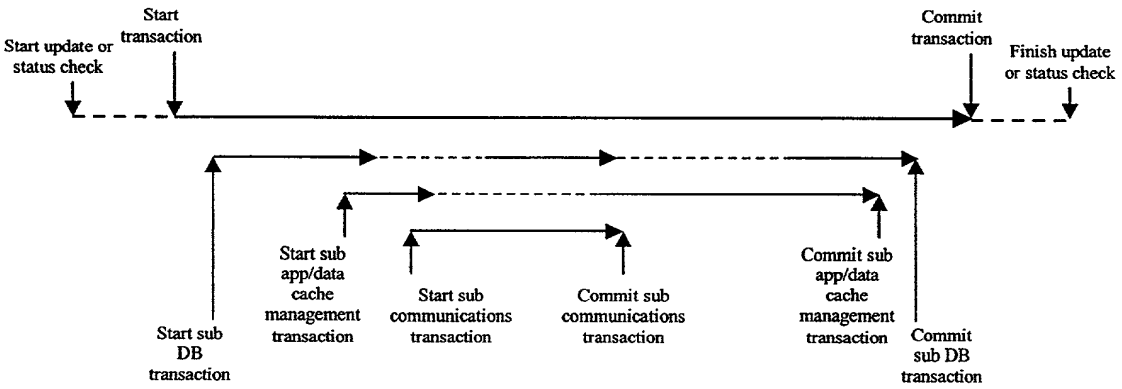
Start update or status check
Start transaction
Commit transaction
Finish update or status check
Start sub DB transaction
Start sub app/data cache management transaction
Start sub communications transaction
Commit sub communications transaction
Commit sub app/data cache management transaction
Commit sub DB transaction

FIG. 3

Application Identification Table

Column	Data Type	Length	Description
appURL	String of unicode characters	Variable length	Application URL, comprising protocol name, host address, path, and application name. Example: http://www.mysite.com/asp/myapp.
appID	Unsigned integer	4 bytes	Unique identifier for the corresponding application URL.

FIG. 4

Data Identification Table

Column	Data Type	Length	Description
dataURL	String of unicode characters	Variable length	Data URL, comprising protocol name, host address, path, and data file name or a database query. Example: http://www.mysite.com/data/mydata.
dataID	Unsigned integer	4 bytes	Unique identifier for the corresponding data URL.

FIG. 5

Compression Methods Table

Column	Data Type	Length	Description
compName	String	Variable length	Data compression method name.
compID	Unsigned integer	1 byte	Unique identifier for the corresponding data compression method ID.

FIG. 6

Application Download Table

Column	Data Type	Length	Description
appID	Unsigned integer	4 bytes	Application identifier.
appSize	Unsigned integer	4 bytes	Size in byte of the corresponding application.
nDownload	Unsigned integer	4 bytes	Number of downloads of the corresponding application by the mobile device.
timeStamp	Unsigned integer	4 bytes	The time stamp of the last download of the corresponding application by the mobile device, based on the corresponding mobile device's local clock.

FIG. 7

Data Download Table

Column	Data Type	Length	Description
dataID	Unsigned integer	4 bytes	Data identifier.
dataSize	Unsigned integer	4 bytes	Size in byte of corresponding data.
nDownload	Unsigned integer	4 bytes	Number of data downloads of the corresponding data by the mobile device.
timeStamp	Unsigned integer	4 bytes	The time stamp of the last download of the corresponding data by the mobile device, based on the corresponding mobile device's local clock.

FIG. 8

Application Storage Table

Column	Data Type	Length	Description
appID	Unsigned integer	2 bytes	Application identifier associated with the corresponding application URL.
nFile	unsigned integer	1 byte	Number of files included in the corresponding application.
fNames	Array of strings of unicode characters	Variable length	Array of the names of all files included in the corresponding application.
appVer	Byte array	16 bytes	Version information of the corresponding execution of the application.
fVers	Array of byte array	Variable length	Array of the version information of all files included in the corresponding application.
root	String of unicode characters	Variable length	Root directory in the local storage where the corresponding application is cached.
nextRel	Unsigned interger	4 bytes	Next release time of the corresponding application, based on the corresponding origin application server's local clock.
lang	Unsigned integer	1 byte	Code, indicating the type of computer language used to write the corresponding application.
flagSet	Unsigned integer	1 byte	Flag: • The 1st bit to 7th bit are reserved; • If the 8th bit is on, the corresponding application is out-of-date.
nUpdate	Unsigned integer	2 byte	Number of updates on the corresponding application by the corresponding mobile device since the application has been cached.
updateRate	Unsigned integer	1 byte	Average update rate (1-100 in percentage) for the *nUpdate* updates on the corresponding application by the corresponding mobile device.
CBI	Unsigned integer	4 bytes	Cache Benefit Index.

FIG. 9

Data Storage Table

Column	Data Type	Length	Description
dataID	Unsigned integer	2 bytes	Data Identifier of the corresponding data URL.
root	String of unicode characters	Variable length	Root directory in the local storage where the corresponding data is stored.
flagSet	Unsigned integer	1 byte	Flag: • If the 1st bit is on, the corresponding application is updated by at least one mobile device. • The 2nd bit to 7th bit are reserved; • If the 8th bit is on, the corresponding application is out-of-date.
dataVer	Byte array	16 bytes	Version information of the corresponding execution of the data.
nUpdate	Unsigned integer	2 byte	Number of updates on the corresponding data.
updateRt	Unsigned integer	1 byte	Average update rate (1-100 in percentage) for the *nUpdate* updates on the corresponding data.
CBI	unsigned integer	4 bytes	Cache Benefit Index.

FIG. 10

Application Execution Table

Column	Data Type	Length	Description
appID	Unsigned integer	2 bytes	Unique identifier for the corresponding application URL.
appVer	Byte array	16 bytes	Version information of the corresponding execution of the application.
timeStamp	Unsigned integer	4 bytes	Time stamp of the corresponding execution of the application, based on the mobile terminal's local clock.
peCBI	Unsigned integer	4 bytes	Per-execution Cache Benefit Index, i.e., the number of bytes saved from wireless communications by caching the application. It is 0 if the application was not cached before the corresponding execution; it is the application size in byte if the application was cached and up-to-date before the corresponding execution; it is the application size in byte, subtracted by the size in byte of the updated part otherwise.

FIG. 11

Data Access Table

Column	Data Type	Length	Description
dataID	Unsigned integer	2 bytes	Data Identifier of the corresponding data URL.
dataVer	Byte array	16 bytes	Version information of the corresponding execution of the data.
timeStamp	Unsigned integer	4 bytes	Time stamp of the corresponding access to the data, based on the mobile terminal's local clock.
paCBI	Unsigned integer	4 bytes	Per-access Cache Benefit Index, i.e., the number of bytes saved from wireless communications by caching the data. It is 0 if the data was not cached before the corresponding access; it is the data size in byte if the data was cached and up-to-date before the corresponding access; it is the data size in byte, subtracted by the size in byte of the updated part otherwise.

FIG. 12

Application cache change table

Column	Data Type	Length	Description
appID	Unsigned integer	2 bytes	Application identifier associated with the corresponding application URL.
flagSet	Unsigned integer	1 byte	Flag: • If the 1st bit is on, the application is added to the application caching storage on the mobile device; • If the 2nd bit is on, the application is removed from the application caching storage on the mobile device; • The 3rd bit to 8th bit are reserved.

FIG. 13

Data cache change table

Column	Data Type	Length	Description
dataID	Unsigned integer	2 bytes	Data identifier associated with the corresponding data URL.
flagSet	Unsigned integer	1 byte	Flag: • If the 1st bit is on, the data is added to the data caching storage on the mobile device; • If the 2nd bit is on, the data is removed from the data caching storage on the mobile device; • The 3rd bit to 8th bit are reserved.

FIG. 14

Configuration Table

Column	Data Type	Length	Description
Name	String of Unicode characters	Variable length	Parameter name. One of the following names is permitted: ***MAX_CACHE_SIZE***: *The maximum memory size in byte for the intelligent caching.* ***FREE_MEM_SIZE***: *The memory size in byte that is free for caching. It is MAX_CACHE_SIZE initially.* ***SRCH_RSLT_SIZE***: *The maximum number of search result to be received from a gateway at a time. 0 means no limitation for the size.* ***EFFECT_PERIOD***: *The amount of time application and data records can be stored in the micro DB since the last execution of or access on the corresponding applications or data.* ***APP_CACHE_ROOT***: *The top-level directory where applications can be cached.* ***DATA_CACHE_ROOT***: *The top-level directory where data can be cached.* ***NETWORK_TYPE***: *The wireless network type, either packet-switched network or circuit-switched network.* ***SESSION_TTL***: *The time-to-live of a newly created logical session, during which, the session may be reused.* ***LAST_APP_ID***: *The last assigned application identifier. It will be 0 initially.* ***LAST_DATA_ID***: *The last assigned data identifier. It will be 0 initially.* ***LAST_APP_KEY_ID***: *The last assigned application-key pair identifier. It will be 0 initially.* ***LAST_UPLOAD_TM***: *The time stamp for the last successful piggyback of the user operation histories.* ***MAX_QUIET_TM***: *The maximum amount of time allowed between two user operation histories upload operations. The user operation histories will be uploaded automatically after the amount of time even the user does not create any request to a gateway.* ***COMM_TIMEOUT***: *The timeout time for a communication message.* ***COMM_RETRY_NO***: *The permitted number of retries for a communication failure.*
Value	String of unicode characters	Variable length	Parameter value. It needs to be reinterpreted for different parameter names.

FIG. 15

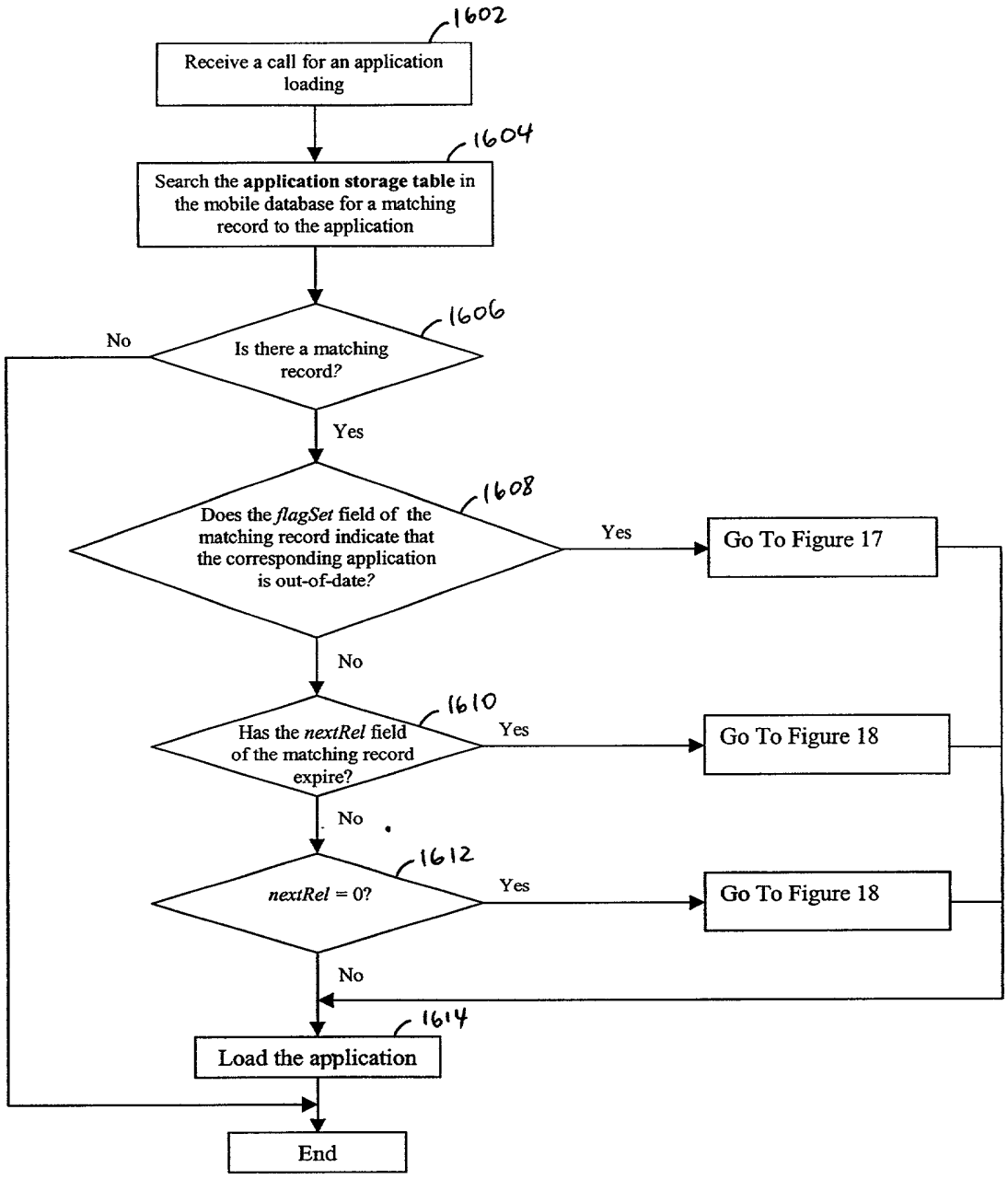
1602
Receive a call for an application loading
1604
Search the application storage table in the mobile database for a matching record to the application
1606
Is there a matching record?
No
Yes
1608
Does the flagSet field of the matching record indicate that the corresponding application is out-of-date?
Yes
Go To Figure 17
No
1610
Has the nextRel field of the matching record expire?
Yes
Go To Figure 18
No
1612
nextRel = 0?
Yes
Go To Figure 18
No
1614
Load the application
End

FIG. 16

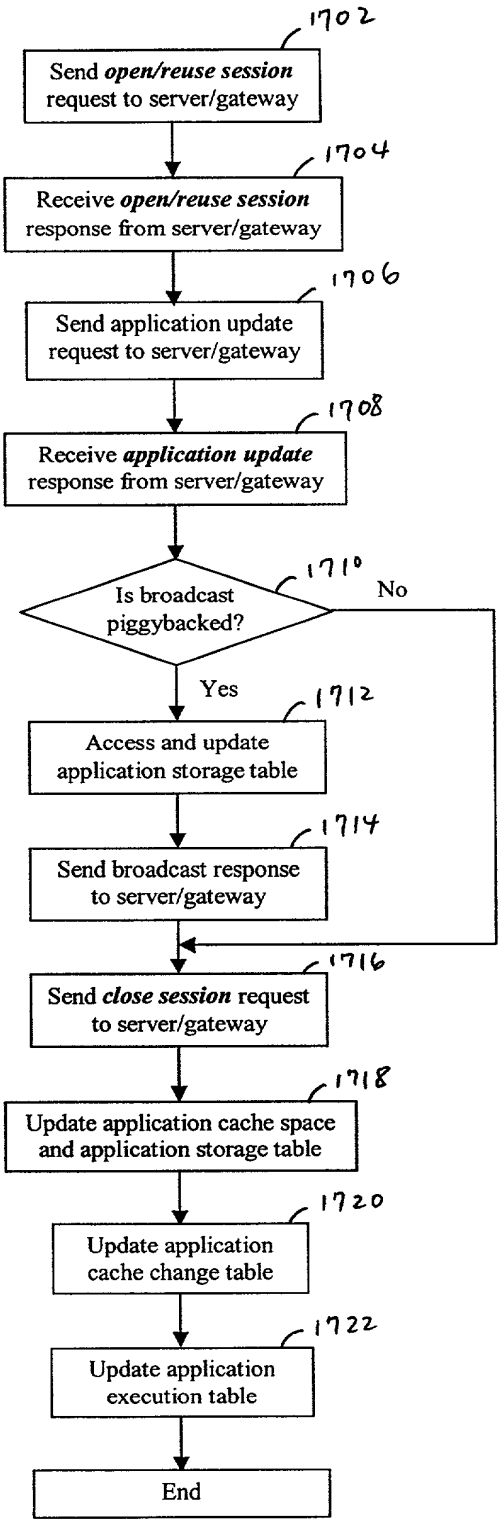
1702
Send *open/reuse session* request to server/gateway
1704
Receive *open/reuse session* response from server/gateway
1706
Send application update request to server/gateway
1708
Receive *application update* response from server/gateway
1710
Is broadcast piggybacked?
No
Yes
1712
Access and update application storage table
1714
Send broadcast response to server/gateway
1716
Send *close session* request to server/gateway
1718
Update application cache space and application storage table
1720
Update application cache change table
1722
Update application execution table
End

FIG. 17

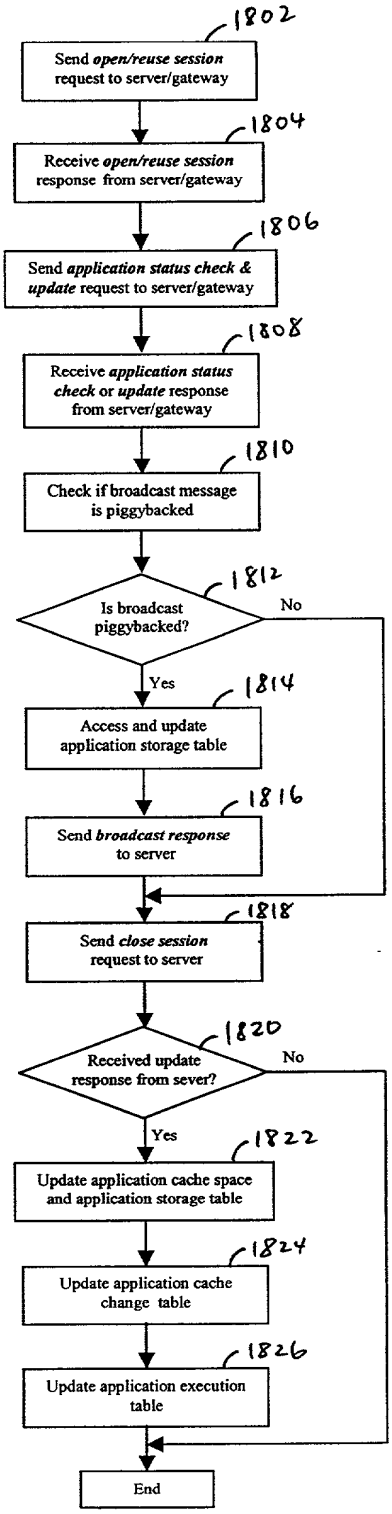
1802
Send open/reuse session request to server/gateway
1804
Receive open/reuse session response from server/gateway
1806
Send application status check & update request to server/gateway
1808
Receive application status check or update response from server/gateway
1810
Check if broadcast message is piggybacked
1812
Is broadcast piggybacked?
No
Yes
1814
Access and update application storage table
1816
Send broadcast response to server
1818
Send close session request to server
1820
Received update response from sever?
No
Yes
1822
Update application cache space and application storage table
1824
Update application cache change table
1826
Update application execution table
End

FIG. 18

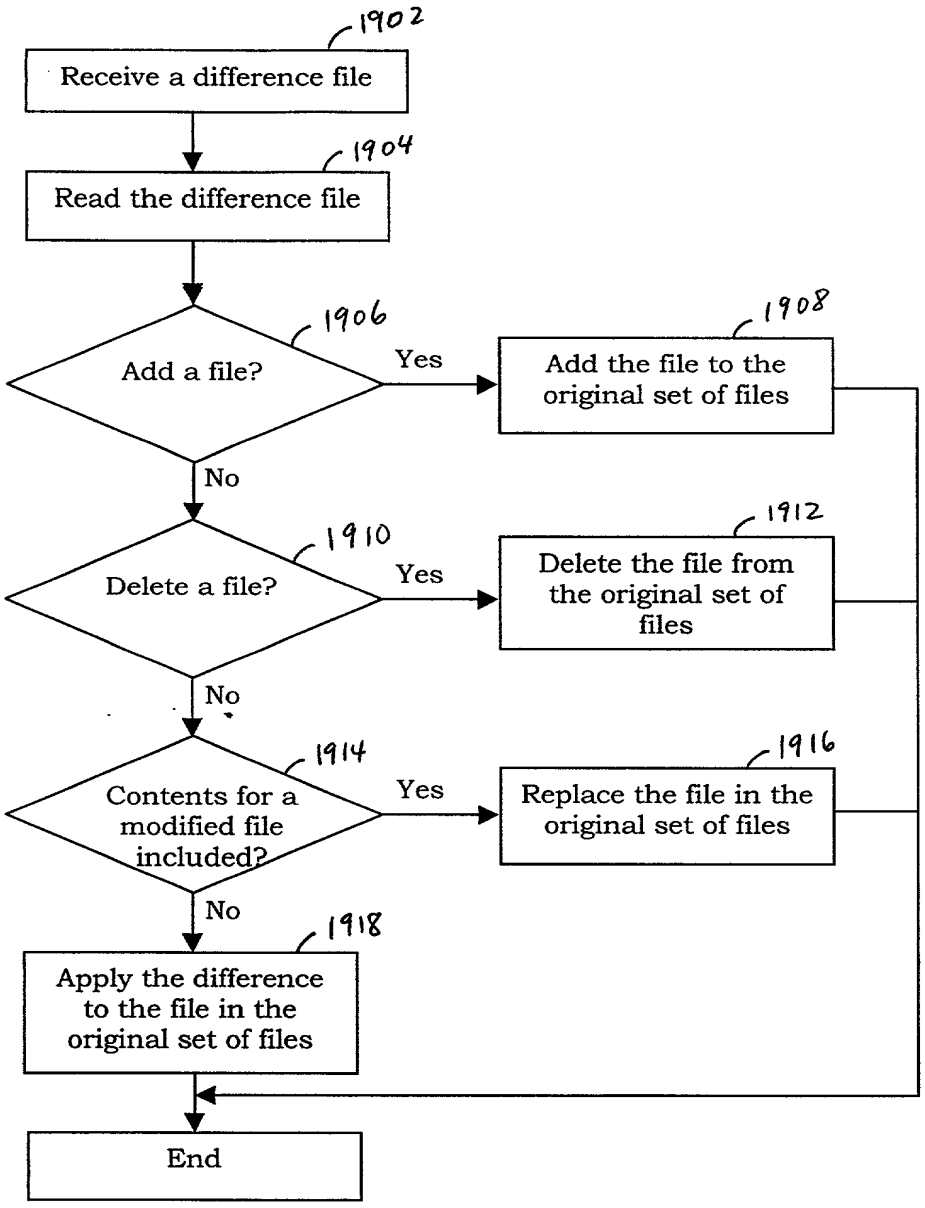
1902
Receive a difference file
1904
Read the difference file
1906
Add a file?
Yes
1908
Add the file to the original set of files
No
1910
Delete a file?
Yes
1912
Delete the file from the original set of files
No
1914
Contents for a modified file included?
Yes
1916
Replace the file in the original set of files
No
1918
Apply the difference to the file in the original set of files
End

FIG. 19

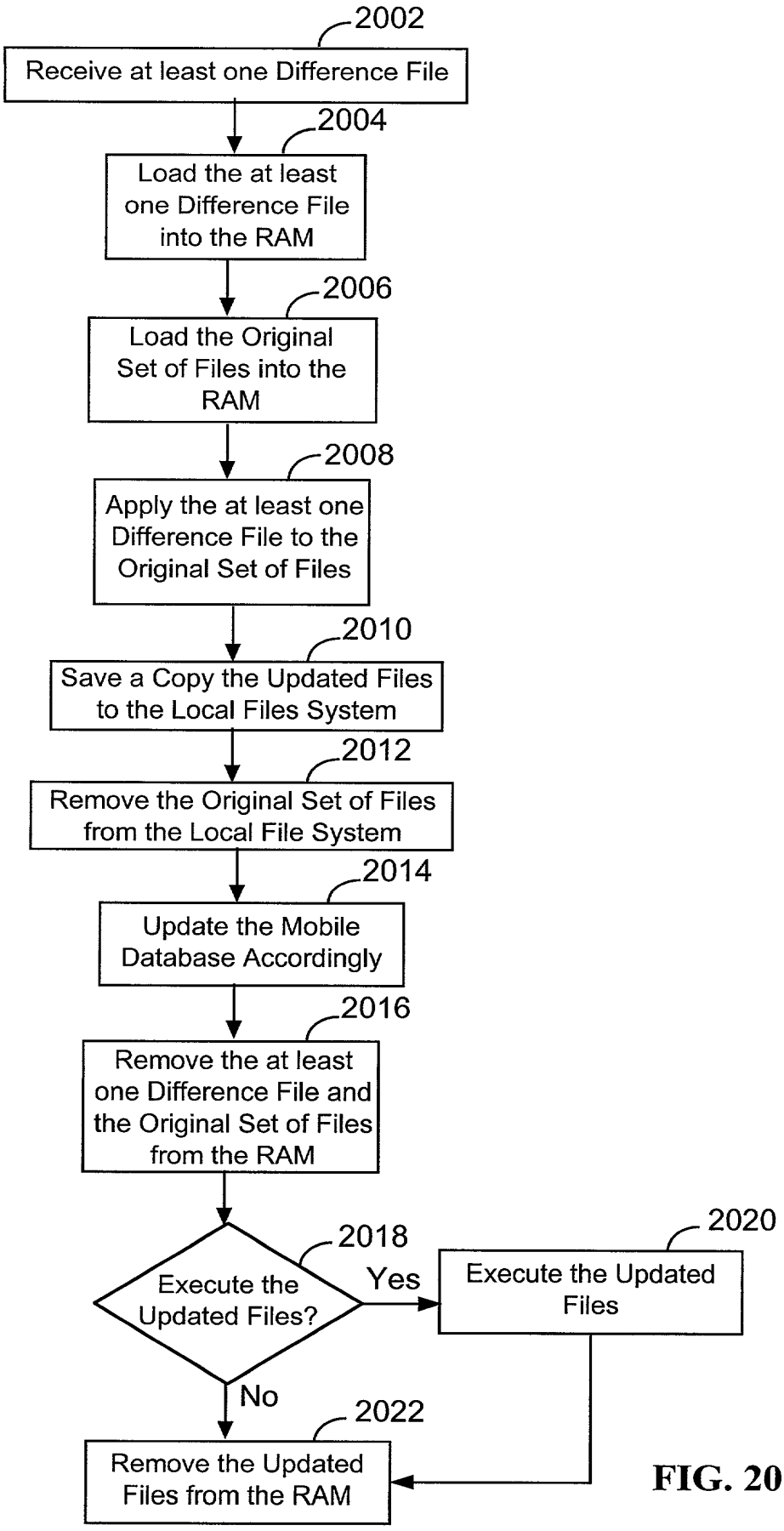
2002
Receive at least one Difference File
2004
Load the at least one Difference File into the RAM
2006
Load the Original Set of Files into the RAM
2008
Apply the at least one Difference File to the Original Set of Files
2010
Save a Copy the Updated Files to the Local Files System
2012
Remove the Original Set of Files from the Local File System
2014
Update the Mobile Database Accordingly
2016
Remove the at least one Difference File and the Original Set of Files from the RAM
2018
Execute the Updated Files?
Yes
2020
Execute the Updated Files
No
2022
Remove the Updated Files from the RAM

FIG. 20

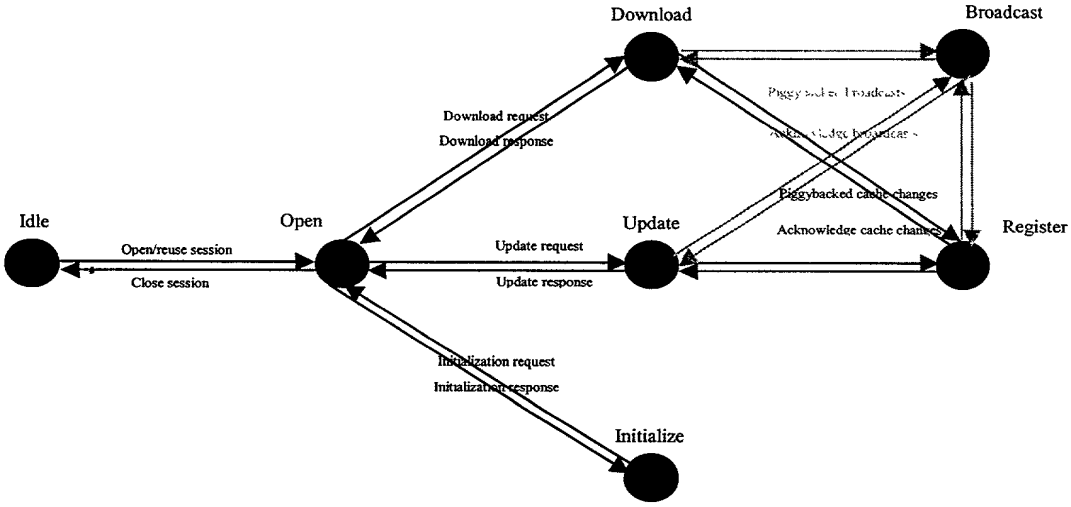
Download
Broadcast
Download request
Download response
Idle
Open
Update
Register
Open/reuse session
Close session
Update request
Update response
Piggybacked cache changes
Initialization request
Initialization response
Initialize

FIG. 21